



## PSTAT 5A: MT1 Practice Problems

Summer Session A 2023, with Ethan P. Marzban

---

Please also take a look at the past exams posted to the GitHub site, for additional practice problems.

- Three numbers are to be selected from the set  $\{1, 2\}$ . Suppose that the selection of numbers is done at random, and that the numbers are replaced after each selection (so the same number could be selected more than once). Additionally, suppose that the order in which the numbers are selected is important. The three numbers are then recorded.
  - Is it possible to express the outcome space  $\Omega$  for this experiment as a table? If so, express  $\Omega$  as a table. If not, explain why not.
  - Express the outcome space  $\Omega$  for this experiment as a tree.
  - How many outcomes are in  $\Omega$ ? Justify your answer.
  - Let  $F$  denote the event “the sum of the three numbers is equal to 4.” Use the Classical Approach to Probability to compute  $\mathbb{P}(F)$ . A fully correct answer should list out the elements in  $F$  explicitly.
- Suppose  $A$  and  $B$  are independent events with  $\mathbb{P}(A) = 0.4$  and  $\mathbb{P}(B) = 0.5$ .
  - Compute  $\mathbb{P}(A \cup B)$ .
  - Compute  $\mathbb{P}(A^C \cap B^C)$ .
  - Compute  $\mathbb{P}(A \cap B^C)$ . **Hint:** Sketch a Venn Diagram.
- In a particular group of people, 50% have blue eyes and 20% wear glasses. Furthermore, 20% of those who have blue eyes wear glasses.
  - What is the probability that a randomly-selected person from this group has blue eyes and wears glasses? Remember that a fully correct answer should clearly define events and notation, and translate the information provided in the problem statement into the notation established.
  - What is the probability that a randomly-selected person from this group has blue eyes or wears glasses, but not both?
  - Are the events “randomly-selected person has blue eyes” and “randomly-selected person wears glasses” independent? Why or why not?

4. Daria collects data on the political beliefs and relationship status of several individuals. Below is a contingency table summarizing her results:

Beliefs	Relationship		
	Single	Dating	Married
Liberal	30	20	20
Moderate	40	25	25
Conservative	25	30	30

- (a) What is the probability that a randomly-selected person has conservative beliefs?
- (b) What is the probability that a randomly-selected person is single?
- (c) What is the probability that a randomly-selected person has moderate beliefs and is married?
- (d) A person is selected at random, and it is noted that they are dating. What is the probability that they have liberal beliefs?
5. Let  $X = \{-1, 0, 1, 2, 10\}$ .
- (a) Compute  $\bar{x}$ , the mean of  $X$ .
- (b) Compute  $s_X$ , the standard deviation of  $X$ .
- (c) Compute the **mean absolute deviation** (MAD) of  $X$ , defined as

$$\text{mad}(X) = \frac{1}{n} \sum_{i=1}^n |x_i - \bar{x}|$$

- (d) Compute  $\text{range}(X)$ , the range of  $X$ .
6. A box contains tickets numbered 1 through 10. John reaches in and selects two tickets at random, not replacing the first ticket.
- (a) Suppose that the order in which John draws the tickets is important. How many elements are in  $\Omega$ , the outcome space for this experiment?
- (b) Suppose that the order in which John draws the tickets is not important. How many elements are in  $\Omega$ , the outcome space for this experiment?
- (c) Suppose again that the order in which John draws the tickets is important. Use the Classical Approach to Probability to compute the probability that both of the numbers John selects are even.
- (d) Suppose again that the order in which John draws the tickets is not important. Use the Classical Approach to Probability to compute the probability that both of the numbers John selects are even.

## Some Practice Multiple Choice Questions

**Problem 7 - 10 refer to the following situation:** Jim would like to write a function called `sign()` that takes in a single input `x` and returns "positive" if `x` is positive, "zero" if `x` is zero, and "negative" if `x` is negative. To that end, he has written the following skeleton code but is missing some important pieces (assume this is the **only** code in Jim's Jupyter Notebook, and that there are **no** other code cells before or after):

```
def sign(x):  
    if x Blank 1 0:  
        return "negative"  
  
    Blank 2 x Blank 3 0:  
        return "zero"  
  
    else:  
        return "positive"
```

---

7. What should go in Blank 1?

- A. <
- B. <=
- C. >
- D. >=
- E. None of the above.

8. What should go in Blank 2?

- A. else
- B. else if
- C. elif
- D. e\_if
- E. None of the above.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

9. What should go in Blank 3?

- A. =
- B. ==
- C. !=
- D. =!
- E. None of the above.

10. What is missing from the body of Jim's function (specifically, this is something we mentioned in Lab that should *always* be included with a function)

- A. An output statement
- B. A return statement
- C. An exception statement
- D. A docstring
- E. None of the above.

.....

11. Given two events  $E$  and  $F$  with  $\mathbb{P}(E) = \mathbb{P}(F) = 0.5$  and  $\mathbb{P}(E \cap F) = 0$ , which of the following must be true?

- A.  $E$  and  $F$  are both disjoint and independent
- B.  $E$  and  $F$  are disjoint but not independent
- C.  $E$  and  $F$  are not disjoint but independent
- D.  $E$  and  $F$  are neither disjoint nor independent

12. Which module contains the function `Table()` that was used in Lab 2?

- A. `numpy`
- B. `tables`
- C. `datascience`
- D. `ds`
- E. None of the above

Name: \_\_\_\_\_

Date: \_\_\_\_\_

13. Suppose the variable  $x$ , in a Jupyter Notebook, is assigned the value  $[1, 2, 3, 4]$ . What is the result of running  $x[2]$ ?

- A. 1
- B. 2
- C. 3
- D. 4
- E. None of the above